Spectral Gamma-Ray Borehole Log Data Report

Log Event A

Borehole 50-06-06

Borehole Information

Farm : T
Tank : T-106
Site Number : 299-W10-106
N-Coord : 43,502
W-Coord : 75,837
TOC Elevation : 671.42
Water Level, ft : 112.9
Date Drilled : 7/31/1973

Casing Record

Type : Steel-welded
Thickness, in. : 0.237
ID, in. : 4
Top Depth, ft. : 0
Bottom Depth, ft. : 123

Type : Steel-welded
Thickness, in. : 0.280
ID, in. : 6
Top Depth, ft. : 0
Bottom Depth, ft. : 123

Cement Bottom, ft. : 123
Cement Top, ft. : 0

Borehole Notes:

Borehole 50-06-06 was drilled in July 1973 to a depth of 100 ft with 6-in. casing. Data from the drilling log and Chamness and Merz (1993) were used to provide borehole construction information. In March 1977, the borehole was deepened and the 6-in. casing was extended to a depth of 123 ft. Although no information concerning grouting or perforations was provided in the drilling log or Chamness and Merz (1993), it is assumed that portions of the 6-in. casing were perforated and the annulus between the 4-in. and 6-in. casings was filled with grout. This procedure was frequently used during the 1977 campaign to deepen selected T Tank Farm boreholes. In addition, the logging engineer reported that grout was visible between the casings at the ground surface. The thicknesses of the 4-in. and 6-in. casings are presumed to be 0.237 in. and 0.280 in., respectively, on the basis of the published thickness for schedule-40, 4-in. and 6-in. steel tubing.

Equipment Information

Logging System : 2B
Detector Type : HPGe
Detector Efficiency: 35.0 %
Calibration Date : 11/1997
Calibration Reference : GJO-HAN-20
Logging Procedure : MAC-VZCP 1.7.10-1

Logging Information

Log Run Number : 1
Log Run Date : 02/13/1998
Logging Engineer: Alan Pearson
Start Depth, ft.: 0.0
Counting Time, sec.: 200
L/R : L
Shield : N
Finish Depth, ft. : 19.0
MSA Interval, ft. : 0.5
Log Speed, ft/min.: n/a

Log Run Number : 2
Log Run Date : 02/17/1998
Logging Engineer: Alan Pearson
Start Depth, ft.: 18.0
Counting Time, sec.: 200
L/R : L
Shield : N
Finish Depth, ft. : 33.5
MSA Interval, ft. : 0.5
Log Speed, ft/min.: n/a

Log Event A

Borehole 50-06-06

Log Run Number : 3	**Log Run Date :** 02/17/1998	**Logging Engineer:** Alan Pearson			
Start Depth, ft.: 32.5	**Counting Time, sec.:** 200	**L/R :** R	**Shield :** N		
Finish Depth, ft. : 64.0	**MSA Interval, ft. :** 0.5	**Log Speed, ft/min.:** n/a			

Log Run Number : 4	**Log Run Date :** 02/18/1998	**Logging Engineer:** Alan Pearson	
Start Depth, ft.: 63.0	**Counting Time, sec.:** 200	**L/R :** L	**Shield :** N
Finish Depth, ft. : 78.5	**MSA Interval, ft. :** 0.5	**Log Speed, ft/min.:** n/a	

Log Run Number : 5	**Log Run Date :** 02/18/1998	**Logging Engineer:** Alan Pearson	
Start Depth, ft.: 77.5	**Counting Time, sec.:** 200	**L/R :** L	**Shield :** N
Finish Depth, ft. : 105.0	**MSA Interval, ft. :** 0.5	**Log Speed, ft/min.:** n/a	

Log Run Number : 6	**Log Run Date :** 02/19/1998	**Logging Engineer:** Alan Pearson	
Start Depth, ft.: 119.5	**Counting Time, sec.:** 200	**L/R :** L	**Shield :** N
Finish Depth, ft. : 104.0	**MSA Interval, ft. :** 0.5	**Log Speed, ft/min.:** n/a	

Logging Operation Notes:

This borehole was logged by the SGLS in six log runs using a 200-s counting time. The top of the borehole casing, which is the zero reference for the SGLS, is approximately flush with the ground surface. The total logging depth achieved was 119.5 ft.

Increasing dead time was encountered during log run two at a depth of 33.5 ft. As a result, log run three was logged in real time from 32.5 to 64 ft. Log runs four, five, and six (63 to 119.5 ft) were logged in live time after the dead time dropped below 40 percent.

Analysis Information

Analyst : D.L. Parker

Data Processing Reference : MAC-VZCP 1.7.9 Analysis Date : 05/22/1998

Analysis Notes :

The pre-survey and post-survey field verification for each logging run met the acceptance criteria established for peak shape and system efficiency. The energy calibration and peak-shape calibration from the accepted calibration spectrum that most closely matched the field data were used to establish the peak resolution and channel-to-energy parameters used in processing the spectra acquired during the logging operation.

This borehole was completed with 4-in.- and 6-in.-diameter casings along the entire logged interval. A casing correction factor for a 0.50-in.-thick steel casing was applied to the concentration data because it most closely matches the 0.517-in. total combined thickness of the 4-in. and 6-in. casings. The entire annulus between the 4-in. and 6-in. casings is filled with grout, making calculation of accurate radionuclide concentrations impossible. However, man-made and natural radionuclides were identified and apparent concentrations are reported.

Three energy peaks (415, 666 and 695 keV) were used to confirm the presence of Sn-126, and a combination of the 666- and 695-keV peaks were used to present the concentration profile for Sn-126 on the log plots. Because of the low concentrations of Sn-126 and the obscuring of the peaks by other radionuclides, it was necessary for the analyst to carefully examine each peak and judge its validity. The resulting interpretation may not be exactly reconstructed but is representative of the analyst's best judgment.

Approximately 6 ft of water has collected inside the bottom of this borehole. The appropriate water correction factor was not available, so no compensation was applied to the water-filled interval. This resulted in lower reported man-made and natural radionuclide concentration values detected between 114 and 119.5 ft.

Log Plot Notes:

Separate log plots show the man-made and the naturally occurring radionuclides. The natural radionuclides can be used for lithology interpretations. The headings of the plots identify the specific gamma rays used to calculate the concentrations. Uncertainty bars on the plots show the estimated uncertainties for the measurements as 95-percent confidence intervals. Open circles on the plots give the MDL. The MDL of a radionuclide represents the lowest concentration at which positive identification of a gamma-ray peak is statistically defensible.

A combination plot includes the man-made and natural radionuclides, the total gamma derived from the spectral data, and the Tank Farms gross gamma log. The gross gamma plot displays the latest available digital data. No attempt has been made to adjust the depths of the gross gamma logs to coincide with the SGLS data.

A time-sequence plot of the historical gross gamma log data from 1980 to 1990 is presented with the SGLS log plots. A plot that compares the decay rate of the historical gross gamma data with the calculated decay curves for specific radionuclides is also included.

Results/Interpretations:

The radionuclide concentrations identified in this section are reported as only apparent concentrations and are underestimated.

Very high dead time (98 to 99.9 percent) caused distortion of gamma-ray spectra from about 34 to 45.5 ft. Accurate radioassays could not be determined from the limited spectral data collected within this interval; consequently, these data were not included on the log plot. Zones of high dead time (70 to 90 percent) occurred from 46 to 51.5 ft and 54.5 to 57.5 ft. Although the accuracy of the radioassays collected within these intervals is limited, the spectra were reviewed and some were found to be usable for radioassay calculations and are included on the log plot.

The man-made radionuclides Cs-137, Co-60, Eu-154, Eu-152, Sn-126, and Sb-125 were detected by the SGLS. The Cs-137 contamination was measured continuously from the ground surface to 24 ft and nearly continuously from 26 to 34 ft. Isolated occurrences of Cs-137 were detected at 46, 91.5, and 114.5 ft. Co-60 contamination was detected from 33 to 33.5 ft and 46 to 48 ft. Co-60 contamination was also measured continuously from 50 ft to the bottom of the logged interval. Eu-154 contamination was detected from 32.5 to 33.5 ft and continuously from 46 ft to the bottom of the logged interval. Eu-152 contamination was detected from 33 to 33.5 ft and nearly continuously from 52 to 55 ft and 58 to 97.5 ft. Eu-152 contamination was also detected at 104.5 ft and from 112.5 ft to the bottom of the logged interval. Sn-126 contamination was detected nearly continuously from 68 to 80.5 ft, almost continuously from 90 to 92 ft, at 105.5 ft, and almost continuously from 112.5 to 118.5 ft. A small zone of Sb-125 contamination was detected from 83 to 84 ft.

The man-made radionuclide contamination may be more extensive than indicated, but it was not possible to determine the presence of radionuclides in the interval of high dead time.

All of the K-40 and Th-232 concentration values are absent from 34 to 61.5 ft. All of the U-238 concentrations are absent between the ground surface and 1.5 ft, and almost all of the concentrations are absent from 33.5 to 77.5 ft.

Increased Th-232 concentrations were detected from 82 to 91.5 ft. Sharply decreased K-40 and Th-232 concentration values occur from 91.5 to 96 ft and 100 to 103 ft. A sharp peak in the U-238 concentrations occurs between 100 and 103 ft. The K-40 and Th-232 concentration values increase at 108 ft and generally remain elevated to the bottom of the logged interval.

Additional information and interpretations of log data are included in the main body of the Tank Summary Data Report for tank T-106.